Minutes of spin meeting 10/17/07

Ernest started the discussion on the $G\gamma$ factor in the spin motion equation. Apparently, the effect is only important for small G or γ. The new equation Ernest derived is based on the idea that each particle has its own coordinate system and the parallel and perpendicular directions has to be defined relative to the instantaneous velocity of the particles. He first presented Yuri Orlov's comment on his new spin note. One question Yuri raised was that polarimeter measures polarization in the lab frame, after transferring back to the lab frame, will the effect be canceled? Thomas pointed out that what Ernest derived is related to the depolarization effect along the ramp. The key point is that if one wants to use Thomas-BMT equation, the magnetic fields $B_{||}$ and $B_{\perp}$ have to be defined as relative to the particle velocity. The polarization measurement was done usually AFTER resonance crossing, so it is not relevant here. Nevertheless, the spin vector needs to be transformed back to the lab frame. As a matter of fact, one can choose different coordinate system as long as the transverse and longitudinal directions are defined relative to the particle velocity. So far Ernest proved that for the most dominant contribution in the depolarization resonances, namely, the quadrupoles, the effect seems scales as $G\gamma$ instead of $1 + G\gamma$. Mei, Waldo and Thomas commented about the factor for rf dipole, which remains a question to be answered. Alfredo is checking the tracking code SPINK, which probably used the lab frame as the reference system.

Fanglei presented the spin tracking results for slow and fast acceleration rate crossing $36 + \nu$ with 10% and 14% cold snake. She compared the fast ($\alpha = 5\times10^{-5}$) and slow ($\alpha = 2\times10^{-5}$, the actual crossing rate for $36+\nu$) ramp rates as well as with and without horizontal emittance effect. The vertical emittance was set as 2.5πmm-mrad rms emittance and the horizontal emittance was set as 1.6 πmm-mrad rms emittance. Taking into account only vertical emittance, the fast vs. slow acceleration rate gave a 2% polarization difference in both 10% and 14% cold snake case. This implies that final polarization is not sensitive to the crossing speed of the snake resonance near $36+\nu$, but faster rate is better. When horizontal emittance was included, the horizontal resonance effect showed up. There is less polarization loss for the 10% colds snake case (3%) than the 14% case (6%). So faster acceleration through $36+\nu$ does help polarization preservation, especially in the 14% cold snake case. She also tracked particles at fixed vertical emittance ellipses to compare with vertical polarization profile measurtments. The preliminary results showed that there is not much profile, and the behavior of the spin showed some coherence along the energy ramp. More study will follow.

Haixin